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SCALED QUAIL REPRODUCTION IN THE TRANS-PECOS REGION OF TEXAS

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ABSTRACT

Scaled quail (*Callipepla squamata*) populations have declined markedly throughout their range. We monitored hatch rates and nest placement of radio-marked female scaled quail ($n = 210$) in Pecos County, Texas relative to the availability and location of 'spreader dams' (i.e., shallow water catchments) through the nesting seasons of 1999 and 2000. Hatch rates were high both years (i.e., 67 and 84% for 1999 and 2000, respectively). The predominant nesting microhabitat was tobosa (*Pleuraphis mutica*), which accounted for 85% of the nests located. We failed to document any direct impacts of spreader dams on nesting ecology of scaled quail.

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Key words: *Callipepla squamata*, Chihuahuan desert, reproduction, scaled quail, Trans-Pecos, Texas

INTRODUCTION

Scaled quail declined ~ 4% annually from 1966 to 2010 throughout their range (Church et al. 1993, Sauer et al. 2011), and experienced a precipitous decline (annual rate of decline > 8%) since about 1989 over most of their range in Oklahoma and north Texas (Rollins 2000). Scaled quail populations declined markedly across most of their range in Texas from 1988–2001 (Fig. 1), but notable exceptions occur where populations remained relatively high. One exception was a private ranch in Pecos County, Texas during 1997. The relatively greater abundance of scaled quail at this site was attributed by the landowner to a network of 'spreader dams' (shallow water catchments) that provided better quality microhabitats for scaled quail (i.e., foci of enriched herbaceous diversity and cooler microclimates).

Scaled quail have been the focus of numerous studies over the past 70 years (Bent 1932, Wallmo 1957, Schemnitz 1961, Campbell et al. 1973), but have lagged behind northern bobwhites (*Colinus virginianus*), especially since the advent of radiotelemetry (Rollins 2000, Rollins et al. 2009). Reports by Bent (1932), Wallmo (1957), Schemnitz (1964), and Campbell et al. (1973) were primarily natural history studies based on field observations that provided general ecological information about scaled quail, but little information on nesting ecology, movements, or population dynamics. These data are critical for scaled quail management given extensive declines since the 1960s. We initiated a project in 1999 to: (1) study population dynamics of scaled quail, and (2) document nest site placement relative to spreader dams.

STUDY AREA

This study was conducted on 12,000 ha of private land in southeastern Pecos County, ~ 32 km southwest of Fort Stockton, Texas in the Trans-Pecos ecoregion (Fig. 2). The vegetation was dominated by desert scrub and consisted mainly of creosote (*Larrea tridentata*), tarbush (*Flourensia cernua*), and honey mesquite (*Prosopis glandulosa*). Incidental species included allthorn (*Koeberlinia spinosa*) and catclaw mimosa (*Mimosa biuncifera*). Common grasses included tobosa (*Pleuraphis mutica*) and bush muhly (*Muhlenbergia porteri*). Major land uses included cattle ranching; grazing on study sites consisted of a cow-calf enterprise on a rotational basis at a light to moderate stocking rate (e.g., 30 ha/animal unit).

We compared nesting ecology of scaled quail across 3 sites. Site 1 (treatment) consisted of ~ 6,000 ha east of

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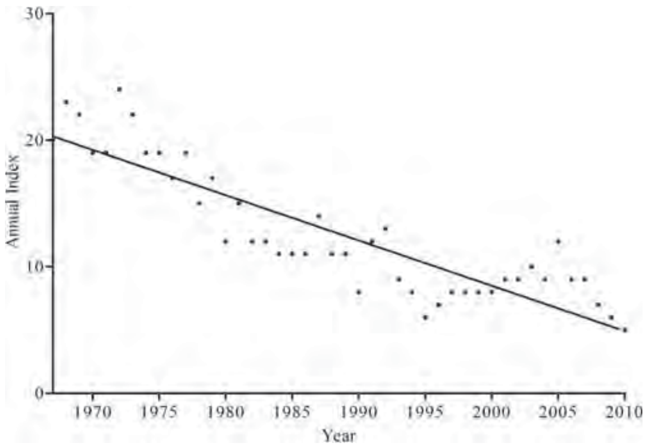

Fig. 1. Scaled quail population trends in Texas from 1967 to 2010 as estimated from Breeding Bird Survey data (Sauer et al. 2011).

the ranch headquarters characterized by numerous spreader dams. Site 2 (positive control) was ~ 800 ha within a larger 2,500-ha area north of the ranch headquarters where quail had access to water and/or green vegetation year-round (via the irrigated lawn and surrounding areas). The positive control (4,500 ha) also included spreader dams. Site 3 (negative control) was ~ 4,500 ha east of site 1. Site 3 did not have spreader dams, although livestock watering points (concrete troughs) were available about every 2.5 km. All sites had similar vegetation and topography with the exception of the microhabitats provided by spreader dams and the area immediately adjacent to the ranch headquarters.

METHODS

We captured scaled quail during March 1999 and 2000 using standard funnel traps baited with milo, and banded them with aluminum, individually-numbered leg bands. Female quail were radiomarked with a ~ 7-g mortality-sensitive neck-loop transmitter (Telemetry Solutions, Concord, CA, USA). Radio-marked quail were monitored twice weekly during spring and summer (e.g., Mar–Aug) 1999 and 2000. Birds were located twice weekly until behavioral indications suggested nest initiation. Nests were located to estimate clutch size and identify nest substrate, and subsequently monitored until hatching or nest loss. Nest initiation was calculated by back-dating based on laying 1 egg every 1.5 days. Nest site availability was estimated by counting the number of

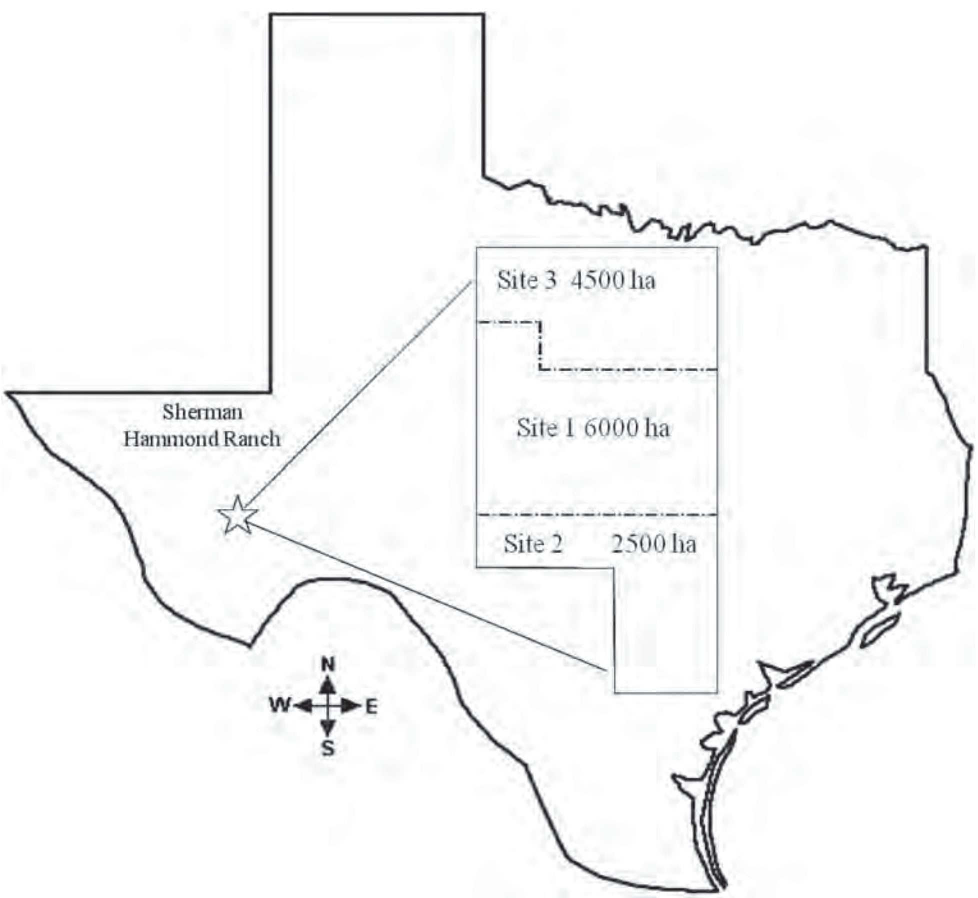

Fig. 2. Location of study areas on the Hammond Ranch, Pecos County, Texas, 1999–2000. Sites 1 (treatment) and 2 (positive control) had spreader dams whereas site 3 (negative control) did not.

suitable clumps of grass that occurred within a 2.0-m belt transect (Slater et al. 2001).

Arthropod sampling was conducted prior to vegetation sampling to minimize disturbance. Twenty-five random points were chosen and a global positioning system (GPS) was used to navigate to the nearest spreader dam. Sweep nets were used for sample collection. Seven sweeps were conducted inside the spreader dam as well as along an adjacent transect $>$ 25 m from the spreader dam. Arthropods were dried and weighed to compare mass inside and outside the spreader dam.

We measured herbaceous biomass at 25 spreader dams in July 1999. A random numbers table was used to define coordinates within the boundaries of the site. Sample points were located using a handheld GPS unit. An additional 25 100-m transects were established at least 50 m from spreader dams in a randomly assigned heading. Vegetation sampling was conducted using a 0.25-m^2 sampling frame. Three quadrats were clipped to ground level inside the spreader dam as were 3 random quadrats along a transect outside the area. Vegetation samples were air-dried to a constant mass and then weighed. Samples were not sorted to species and the data respresent total herbage biomass.

RESULTS

Trapping

We captured 497 scaled quail (290 females, 207 males), 269 in 1999 (154 females [57%], 115 males [43%]) and 228 in 2000 (136 females [59%], 92 males [41%]). Most birds captured were adults in 1999 ($n = 193$ [72%]) and 76 were juveniles (28%). The majority of birds trapped in 2000 were juveniles ($n = 186$ [82%]) with 42 adults (18%). We radiomarked 120 females (40 per site) in 1999 and 90 (30 per site) in 2000. Adults comprised 75% of the females marked on each site in 1999, where 75% of females marked on each site were juveniles in 2000.

Nesting

Sixty-nine of 210 (33%) females established 74 nests over both years of the study with an average clutch size of 11.0 eggs. There was no difference in hatch rates on sites with (sites 1, 77%, and 2, 73%) or without spreader dams (site 3, 62%). Only 1 of 74 nests was in a spreader dam, and it was depredated. The next closest nest was $\sim$ 1 m from the nearest spreader dam.

Thirty-seven (31%) birds established 43 nests during 1999 with the first nest observed on 11 April. We estimated the nest was initiated on 5 April based on backdating, and defined this date as the beginning of the 1999 nesting season. Twenty-nine of 43 nests (67%) hatched across all sites of which 6 were renests by 5 hens. Five nests represented second nests, and 1 represented a third nesting attempt. Five of the 6 multiple nesting attempts were successful.

Thirty-one of 90 (34%) hens established 31 nests during 2000. Nesting was delayed by 30 days relative to the 1999 season, presumably because of a dry winter and spring. The first nest was observed on 11 May. We estimated the nesting season began on 7 May based on back-dating. Twenty-six of 31 nests hatched (84%) across all sites. Hatch rates were similar across all sites in 2000 (site 1, 82%; site 2, 82%; and site 3, 88%). No nests were in or adjacent to spreader dams with the nearest nest 15 m from a spreader dam. No multiple nesting attempts were observed.

Nest Site Availability

Tobosa and bush muhly were the nesting substrates most available across all sites. Thirty-eight of 43 nests in 1999 were established in tobosa with the remainder in bush muhly. We estimated 422 suitable nest sites per ha, 97% of which were in tobosa. Nest site results were similar in 2000 with tobosa and bush muhly the dominant nesting substrate. Twenty-eight of 31 nests were established in tobosa in 2000. We estimated 312 suitable nest sites per ha in 2000, 95% of which were in tobosa.

Vegetation and Arthropod Analysis

Spreader dams significantly influenced overall plant biomass and arthropod abundance. Plant biomass inside the area influenced by spreader dams (mean $\pm$ SD $= 98.8 \pm 8.06$ g) was 23 times greater than corresponding areas outside spreader dams (4.3 ± 2.94 g). Arthropod abundance inside the area influenced by spreader dams (0.9 ± 0.14 g) was 4.5 times greater than corresponding areas outside spreader dams (0.2 ± 0.08 g).

DISCUSSION

Spreader dams produced more mesic microhabitats that responded with greater plant and arthropod diversity and biomass. However, these mesic environments were not used as nest sites, as only 2 of 74 nests were in or adjacent to spreader dams. Lerich (2002), in a similar study 90 km southwest of our study area, also was unable to show any contribution or use of spreader dams by radio-marked quail and concluded spreader dams had no effect on scaled quail. Rollins et al. (2009) failed to detect any difference in survival of breeding females across the 3 treatment sites used for our study.

Spreader dams were not used for nest sites, but they may provide benefits beyond the scope of our study. Greater arthropod abundance may have improved brood habitat and increased chick survival and recruitment, but we did not monitor these aspects of reproduction. Benefits of spreader dams to quail, if any, may accrue during the fall and winter in the form of cover or by providing a reliable seed source. Spreader dams likely green up earlier in the year (i.e., late winter, early spring) than surrounding areas and could provide green vegetation for scaled quail. We did not investigate scaled quail ecology in fall or winter in our study, but such studies are warranted.

We observed high hatch rates (67 and 84% for 1999 and 2000, respectively) for quail nests suggesting cover conditions (screening and nesting) were more important for scaled quail hatch rate than the mesic microhabitats provided by spreader dams. Pleasant et al. (2006) also concluded that improved cover conditions caused by precipitation resulted in higher hatch rates (44 and 64% for 1999 and 2000, respectively). Our study sites were conservatively stocked with livestock relative to most ranches in this region. This likely resulted in more abundant nesting cover (e.g., tobosa) across the landscape (as opposed to small islands of nesting habitat provided by spreader dams).

MANAGEMENT IMPLICATIONS

Spreader dams are an attempt to manipulate the influence of rainfall upon habitat conditions. Increased vegetative cover, while not demonstrating positive influences to scaled quail during this study, may be beneficial in Chihuahuan Desert rangelands. Appropriate grazing strategies combined with spreader dams may provide increased vegetative and arthropod biomass.

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